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Materials Application Center—Educational Focal Point of Metal Show in Detroit
(See Article, p. 5)

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November, 1961

METALS REVIEW

The News Digest Magazine

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HERE'S A NEW CONCEPT IN HEAT TREATING TECHNIQUE.

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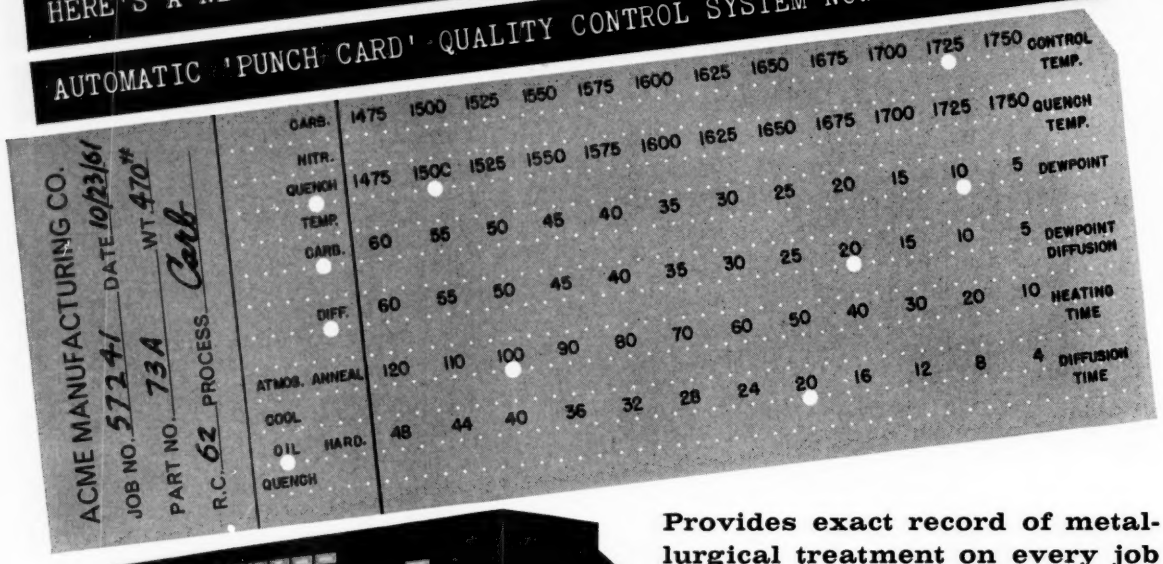

ROBOTROL

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Introduced at the recent ASM Show at Detroit, this new Lindberg Robotrol automatic quality control system has been in development for more than five years. With this punch card system pyrometers, timers, atmosphere control instruments and all the factors on which metallurgical results are dependent are set up and automatically controlled. It is practically impossible for the furnace operator to treat the work improperly.

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November, 1961 Vol. XXXIV, No. 11

METALS REVIEW

The News Digest Magazine

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The Editor's Page

Prior to and during the recent Metal Show and Congress, several of us on the staff at Metals Park had opportunity to become acquainted with our counterparts in the British Iron and Steel Institute. The occasion was the preparations for and the actual visit to this country of some 300 members of the ISI.

ASM had opportunity to entertain some of the British group at two events—the Annual Metal Congress Dinner-Dance and a special visit to Metals Park. Representing ISI on several advance visits to arrange the 1001 details of the tour were Kenneth Headlam-Morley, secretary of the ISI, and two of his aides, Anthony Post and Henry Cleere.

As might be expected, the advance visits gave each group opportunity to talk shop, exchange ideas and become more sympathetic to each other's problems. More importantly, we feel that we have gained new friends which will be retained for many years to come.

Incidentally, Mr. Headlum-Morley is an Honorary Life Member of ASM and at the Dinner-Dance the same honor was bestowed upon Sir Charles Goodeve, president of ISI.

New Metallurgy Building

An interesting device was used to officially open the new Charles M. White Metallurgy Building at Case Institute of Technology during the dedication ceremonies. A ribbon of steel was melted by a high-energy electric discharge.

In a talk prepared for the occasion, Mr. White spotlighted the importance of metallurgy by counting off the many achievements made possible by improved materials and stressed the fact that with the problems now facing us the nation will need metallurgy more than ever.

Major Improvement

With our concentration on the marvels of space flight, nuclear energy and electronic wizardry we are prone to overlook the progress being made in more prosaic areas. For example, our editorial office recently received a news release relating the details of vast improvement in reliability and strength of springs for garters. At first we thought that we finally had arrived at the solution to the problems of sagging sox on careless males. However, closer study revealed that garter springs take their name from their circular shape and that they have a much more important role in industry to hold together certain types of assemblies.

Titanium Subs

A major new use for titanium might be just over the horizon. If so, submarines of the future might be capable of greater speed, payload and diving depth.

The development most likely to permit the use of the light metal in this application is a new welding technique developed at Battelle. Procedures have been perfected which produce crack-free welds in 120,000 psi. yield in 2-in. thick titanium alloy plates. The development represents almost a fourfold increase in welding capability.

Should such an achievement become a fact it might result in a major reduction in maintenance costs on subs due to titanium's noted resistance to salt water corrosion.

New Show City

Perhaps you have already heard about it, but our enthusiasm for the 1962 Metal Show impels us to comment once more. In case you have not heard, the 1962 Show is to be held in New York City. This will be the first visit to the metropolis in about 30 years.

Partially responsible for the decision to move the Show to New York have been the comments of members in the northeastern section of the United States who indicated a strong desire to have this major event brought closer to their home territories.

Personality Sketches

Very soon in *Metals Review*, we hope to start a series of personality sketches on individuals in the field of metals. Particular emphasis will be placed on interesting and unusual types of work being done and on out-of-the-ordinary avocations, hobbies or achievements.

To help us uncover likely subjects for such sketches, we will welcome with open typewriters nominations for such treatment.

One objective of this new feature is to humanize metals engineering and its practitioners. Will you help us?

T. C. Du Mond

Technical Papers Invited for ASM TRANSACTIONS

The ASM Transactions Committee is now receiving technical papers for consideration for publication in the Society's Transactions Quarterly for March 1962.

Many of the papers accepted by the Committee will be scheduled for presentation at the 44th National Metal Congress and Exposition; however, publication of a paper does not necessarily infer that it will be presented at the Society's Convention.

Manuscripts in triplicate, plus one set of unmounted original photographs and original tracings should be sent to the attention of John Parina, Secretary, Transactions Committee, American Society for Metals, Metals Park, Ohio. Detailed instructions for preparation of papers for Transactions Quarterly are available on request.

Transactions Quarterly is available to ASM members at an annual subscription rate of $3 (non-member subscription rate $10 per year).

Materials Application Center— Featured at Detroit Metal Show

This year's ASM Metal Show presented an innovation in the form of an unusual educational exhibit. The technical editorial staff at Metals Park, who devoted several months to its preparation, refer to it familiarly as "MAC"—which, as visitors to the Show discovered, is the abbreviated name for ASM's Materials Application Center.

The concept of MAC is as broad and diversified as the metalworking industry itself. Specifically, it is an exhibit of parts produced by the industry which have performed outstandingly under a variety of difficult industrial conditions. It emphasizes the engineering aspects of materials application in meeting requirements of strength, extreme temperatures, wear and corrosion resistance, or economy and producibility. Thus, the parts on display represent the solutions that have been devised to answer a myriad of materials engineering problems.

Some of the individual exhibits are spectacular; others—by comparison—appeared to be relatively familiar. But all displays were selected because they possessed a high degree of technical merit and served to demonstrate the effective application of materials in industry. The exhibits, all of which were obtained from industry and several governmental agencies were logically arranged according to major classifications, such as wrought and cast ferrous, wrought and cast nonferrous, stainless and heat resistant alloys, etc.

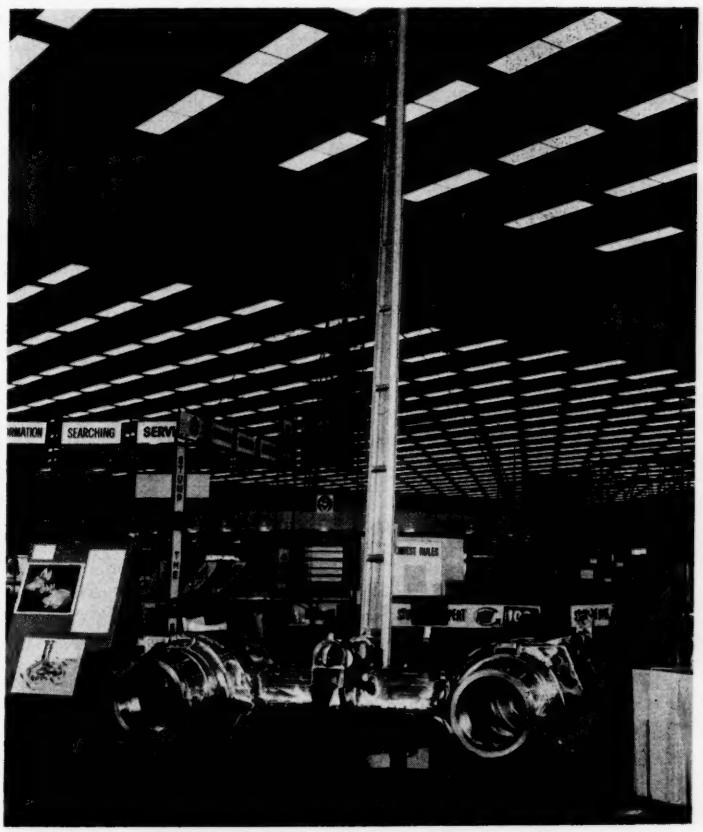
Among the more spectacular items displayed were a 23-ft. wing spar forging, made of 7079 aluminum and fully heat treated (T6 condition). This enormous forging was displayed along with a large H-11 steel forging for the XB-70 main axle beam (see below).

Proving that part size is not the only challenge to be met, other exhibits emphasize ingenuity in both design and fabrication. One very interesting exhibit, for example, was devoted to aluminum honeycombs—ranked among the more unusual materials developed in recent decades. The exhibit told the complete story of honeycomb fabrication from the initial material to its ultimate application.

Nuclear applications were well represented in a variety of individual exhibits that emphasized the familiar metals, such as aluminum and stainless steels, as well as the more exotic materials. By means of these displays, visitors were made more fully aware of the unique fabricating problems inherent in the construction of components for nuclear applications.

The aerospace industry was responsible for several fascinating exhibits that traced the contribution of metals to the conquest of space. In addition to exihibits from major producers, a number of educational displays were provided by governmental agencies, particularly the NASA.

Some displays featured new products and processes—special extrusions developed for the transportation industries, heat treated aluminum bumpers for automobiles, most recent techniques for plating die castings, extra-thin section sand castings, forged molybdenum that isn't brittle, plastic conveyor chain for special purposes. But new or familiar, each display underlines the versatility and engineering "know how" of the metalworking industry.



THESE LARGE FORGINGS *were an outstanding attraction of the Materials Application Center. In foreground is the main axle beam for the XB-70, 2000 mph. airplane —the largest aircraft forging made in a closed die. Material is vacuum melted H-11 die steel heat treated from 280,000 — 300,000 psi. The aluminum closed die forging standing vertically in background is 23 ft. long and weighs 320 lb. It is a wing spar made of alloy 7079-T6*

Wrought Ferrous

One of the most spectacular parts displayed in the wrought ferrous section was a herringbone mill pinion of AISI 2317 steel. Measuring 15 ft. long by 2 ft. in diameter, it is used in the main drive of reduction rolls on a 42-in. hot strip steel mill. Another interesting part was an axle beam for a main landing gear for the XB-70, a bomber that will fly 2000 mph. Made of H11 hot work die steel, the original vacuum-arc melted ingot weighed 18,000 lb. Minimum strength requirements were 280,000 psi. tensile, 220,000 psi. yield and 30% reduction of area (longitudinal).

Wrought Nonferrous

Parts made of nonferrous alloys were well represented, the metals ranging from beryllium, copper, brass and magnesium to titanium, nickel, zinc and aluminum alloys, including products of sintered aluminum powder and honeycomb aluminum foil for aircraft components.

Two automobile bumpers made of experimental aluminum alloys were shown—one was chromium plated with a duplex nickel base plate, similar to that used for steel; the other was polished and anodized. High-strength aluminum alloy aircraft parts, chemically milled for weight reduction, were also featured.

An experimental aluminum radiator for the 1962 Corvette attracted considerable attention, as did the aluminum armor plate. The armor material, 5083-H115, is used for Army tanks which are transported emphasized that copper alloy parts made by this process are strong, have a fine surface finish and can be forged to close dimensional tolerances.

Unusual applications for titanium included intake and exhaust valves for automobile engines, racer axles and marine parts.

Cast Ferrous

An interesting part featured in this section was a centrifugally cast pressure pipe for an atomic power plant. The material: CF-8M (Type 316) stainless steel; the design requirements—2300 psi. at 600° F. A wide range of castings underlined the versatility and range of properties available with the various casting processes and alloys — including malleable, alloy gray iron and steel castings, as well as the unique shell-mold process.

Cast Nonferrous

Many unusual parts cast in light metals, copper alloys and zinc caught the attention of Metal Show visitors. In particular, a die cast 6-cylinder engine block made of an aluminum-silicon alloy (ASTM S12A) was a Show stopper. The successful commercial production of this block marks an important milestone in die casting history. The finished casting, including the gray iron liners, weighs 67 lb.

Stainless and Heat Resisting

A model of a J73C turbojet engine was a lively center of interest in this pavilion. Many engineering parts—turbine and compressor blades and disks, combustion liners and nozzle diaphragms—were displayed and discussed. In addition, many heat and wear resistant alloy parts for gasoline and diesel engines, for heat treating and brazing applications and for missile and high-speed aircraft, were featured throughout this section of the Materials Application Center.

Special Purpose Metals

Designers and materials applications men had a field day in this Show area. Special aerospace hardware included vacuum-sintered tungsten nozzles; plasma-arc rings of machined tungsten; precision forgings of thin section; complex shapes made from extruded tungsten alloy bar stock; porous nickel alloy electrodes for fuel cells; rocket nozzles of zirconium oxide and molybdenum fabricated by spraying on a mandrel; beryllium parts for inertial guidance systems; and a ring forging of molybdenum which is an integral part of an assembly in an intermediate range missile. Parts illustrating special bearing and nuclear applications generated a great deal of engineering interest.

An excellent example of the use of composite materials was an aircraft brake assembly for the DC-8. "Cerametalix" lining material (high heat resistance and constant friction characteristics) is used with aluminum to create an assembly which eliminates rotor warpage and increases safety, efficiency and service life.

In another interesting application —an air-flow modulator assembly for a jet engine—a variety of metallic and non-metallic materials are combined. Glass fabric, 5052-H39 aluminum honeycomb, 6061-T6 aluminum sheet, Type 301 and 321 stainless steels and 4130 alloy steel are used in this assembly.

MAC was the educational focal point of the Detroit Show and visitors agreed that it was well worth the efforts which went into it.

World Information Files

The ASM Documentation and Information Searching Service recently announced a new service known as "ASM World Information Files—1960". These files constitute collections of abstracts covering the world's technical literature for 1960 on a number of special metallurgical subjects currently of wide popular interest. Because these files can be prepared and printed in quantity the Documentation Service is able to offer them at an attractive low price.

The subjects for these searches were selected with the advice of the ASM Documentation Committee. The list is as follows:

SUBJECT	NO. OF ABSTRACTS IN FILE
Columbium	104
Molybdenum	115
Tantalum	78
Tungsten	118
Zirconium and Hafnium	205
All Refractory Metals	781
Cryogenic Properties of Metals	253
Vacuum Melting and Casting	305
Nondestructive Testing	239
Explosive Forming	102
Oxygen Steelmaking	105

Abstracts are printed on separate slips and boxed in convenient cardboard files. Some of the more complex collections are grouped into a number of indexed subheadings.

Similar files covering the literature of 1961 on the same subjects will be available shortly after the first of the year.

The ASM Information Searching Service is also distributing a News-

letter, giving details of how the service is being used by different types of subscribers, comments from users of the service and notes about new developments in the field of literature searching and information retrieval. The first issue of this Newsletter was distributed early in September and the second in October. Anyone who would like to be placed on the mailing list for future issues may do so at no cost by addressing a request to: ASM Documentation Service, American Society for Metals, Metals Park, Ohio.

Relationship of Design and Materials to Fatigue

Thousands of tests under identical conditions are required to establish a stress versus fatigue life curve where less than 10% of identical samples will fail. Firms interested in fatigue life of their product, such as ball bearing manufacturers, must run thousands of tests on their products to establish the statistical predicted life of a group of bearings, according to T. J. Dolan, head of the Department of Theoretical and Applied Mechanics, University of Illinois, who presented a talk on the "Relationship of Design and Materials to Fatigue" at **Chicago-Western.**

Examples of fatigue failure in various shapes and sections were illustrated by slides. Graphs from testing of various materials and severely notched shapes plotted as a function of the number of cycles against stress illustrated the statistical character of fatigue life. Plottings of various materials, from magnesium through low-carbon steel, illustrated the slight difference in fatigue life obtained in changing materials in a severely notched specimen. A more suitable solution was suggested to eliminate fatigue failure by the fact that a 10-15% reduction of stress will, by increasing the affected section, double the fatigue life of a given part.

Fatigue stresses are often caused by microscopic movements between parts pressed together. This "fretting" action has proven to be the cause of failure in equipment where fretting was not considered during design. Plastic and rubber can be used between parts to eliminate the fretting—however, this solution cannot be used where the ambient conditions will attack the rubber or the plastic.

Impact tests cannot be used as a guide in predicting fatigue life since they represent an instantaneous single load, whereas fatigue is a phenomena which takes place over a two-cycle loading. The observed effect on fatigue failure prior to complete failure of a tested part consisted of many minute cracks which, on failure, would propagate into one large crack. The initial cracks are detectible only by the use of extremely high-powered optical equipment.

Residual stresses remaining after heat treating, machining, cold work or shock will cause wide errors in predicting fatigue life. Residual stresses opposing fatiguing thermal stresses set up in service life may tend to increase the fatigue life of the part whereas residual stresses in the same direction will greatly shorten life. Residual stresses in low-strength steels may be eliminated entirely by a single overload on the part in service, completely changing the fatigue life of the part in actual service compared with laboratory tests. *(Reported by R. L. Hosfield)*

Motion of Dislocations

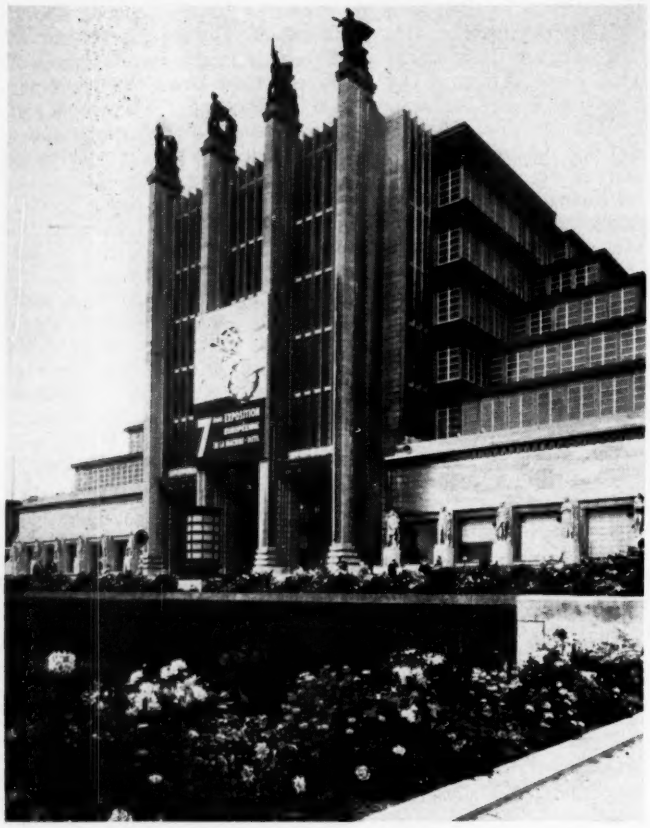
The employment of skillful metallographic techniques during the past decade has shed much light on the nature of submicroscopic dislocations, according to W. G. Johnston, General Electric Research Laboratory, speaking before the **Tri-City** Chapter. This new realm of investigation has disclosed that dislocations are responsible for the slip and twinning modes of plastic deformation in metals and alloys.

In simple language, a dislocation is a wrinkle in the atomic layers of a crystal, much like a wrinkle in the living room carpet. The presence of such crystal imperfections have been revealed by etch pits forming at the intersection of the dislocation with the surface of a single crystal. Using the etch pit technique, the motion of a dislocation can be followed in a single crystal as the crystal is repeatedly stressed, each progression being revealed by a new etch pit. As the applied shear stress is increased, the average velocity of dislocation motion increases. Measurements of average velocity have ranged from effectively zero to near the speed of sound.

The number of dislocations in a crystalline substance has been found to be a function of strain, the number being vastly increased by plastic deformation. Whereas an annealed crystal may contain upwards to a few thousand dislocations per square centimeter, heavily cold worked material may contain as many as 10^{12} dislocations per square centimeter. The resulting increase in internal energy is so great that it can be measured calorimetrically. It is this energy that provides the driving force for recovery and recrystallization.

The complete role played by dislocations in the strength of metals and alloys is yet unknown because the quantitative aspects of dislocations are not entirely understood. However, it is certain that the new concept is becoming an important tool in alloy design. *(Reported by H. L. Strieder)*

SHOWN BUSILY PLANNING *the Chapter Operation's Manual which recently was sent to officers and executive committee members of ASM's 117 chapters are David C. Heckard, left, Armco Steel Corp., chairman of the Chapter Advisory Committee, and T. C. Du Mond, director of Chapter and Member Relations ASM*



Center Hall of the Palais du Centenaire—*Contains 126,000 sq. ft. of clear floor space, a balcony restaurant, post office, cafeteria and other good exposition facilities*

Brussels Machine Tool Show:

Big and Different

By William J. Hilty
ASM Exposition Manager

Two strong impressions were created by the 7th European Machine Tool Exposition in Brussels at the Palais du Centenaire, Sept. 3-12, 1961.

It was massive, occupying all nine buildings in the tremendous Brussels Exposition complex which provides approximately 845,000 sq.ft. of gross exposition space and 415,000 sq.ft. actual exhibit area. Exhibitors totaled 762 manufacturers, including 280 from West Germany, 145 French, 91 Swiss, 87 Italian, 65 British, 38 Belgiums, 21 Dutch, 17 Swedish, 13 Austrian and 5 Danish.

The Exposition was different, especially when compared to an ASM Metal show. There were no name plates or badges to be seen since the average European, it is explained, is definite in his dislike for being identified publicly. Decorations, attention-creating devices or advertising are not permitted in any of the exhibits. The machines themselves had to serve as the entire attraction and they must all be in operation. The only decorations were provided by the exposition management itself in its various reception and lounge areas.

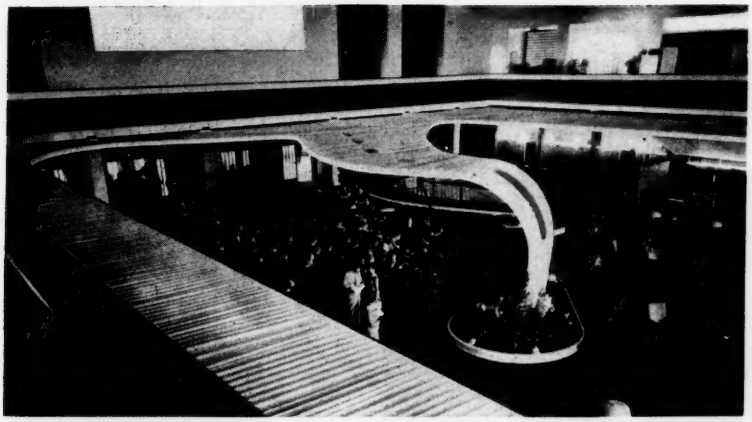
Photography by individuals was not permitted whenever such photography might capture details of any of the machines on exhibit.

There were no technical programs and no effort was made to provide any technical-educational help for visitors beyond that which they could garner in the exhibits themselves.

However, the wide range of machine tools and various other types of metalworking machinery provided literally days of interesting viewing for the visitor. Lathes, drilling machines, milling machines, forming tools and grinders were dominate, with a scattering of small tools, accessories and instruments, some testing, welding and heat treating equipment, plus some cutting material and extruding machines.

Business continued to be reported brisk and at a level unknown in recent years to American manufacturers. European machine tool companies continue to enjoy backlogs of orders with delivery quotes ranging from 12 months to 2 years. The machinery looked well-engineered and well-made in most cases, with exterior finishing usually superior to the average American counterpart, probably because of lower cost labor to spend more time on the niceties. (Britain is currently enjoying 36% lower labor costs than the U. S., France 39%, Germany 45%, Belgium 58%.)

European machine tool expositions are conducted under the direction of the European Committee for Cooperation of the



You can commute to Brussels over a week-end as Bill Hilty did recently to attend the Exposition. Bill left Cleveland at 5:00 p.m. Friday, left Idlewild at 9:00 p.m. by 707 jet and arrived in Brussels at 10:00 a.m. Saturday. Coming home he left Brussels at 2:30 p.m., landed in New York at 7:30 p.m. and in Cleveland at 11:00 p.m.

The Reception Area of the 7th European Machine Tool Exposition—*All visitors having passports (non-Belgium) were requested to register in this separate building. An attractive lounge area, press room, exposition offices and dining facilities for exhibitors were contained here*

The Great Halls of the Palais du Centenaire, Brussels—*Wide areas of unobstructed floor space were provided. Aisles were wide, the working machinery on exhibit was set back far enough so that visitors were not endangered*

Machine Tool Industries which is made up of representative committees from ten countries: Austria, Belgium, Denmark, France, Germany, Great Britain, Italy, The Netherlands, Sweden and Switzerland.

The Exposition rotates on a four-city cycle between Paris, Hanover, Brussels and Milan on a practically every year basis. The next is scheduled for Milan in October 1962 and the Committee is now discussing a new cycle to continue after that.

While attendance for the ten-day exposition has not been provided officially to my knowledge as of this date, it is estimated that some 50,000 to 60,000 general visitors attended with approximately another 20,000 who registered.

To sell in any market requires communications and communications in Europe today demands that sales and instructional materials are printed in at least three and preferably four languages, French, German, English and Italian. If you can speak two or three of these languages, so much the better, but most people can quickly learn to understand the more common messages in any of the four.

No exhibitors were permitted from outside the ten countries mentioned above and exhibitors are not permitted to exhibit in any other exposition or fair in any of these countries in the same year.

Quite a few American-designed machine tools were in evidence, due to the increasing number of subsidiary and licensing combinations being formed between American and European companies. Many names of exhibitors were familiar to Americans including Sciaky (France), Square D (Great Britain), Warner-Swasy Asquith (Great Britain); 300 to 400 Americans visited the Show, a great many of whom are distributors in the U. S. for the European firms exhibiting.

The Palais du Centenaire, site of this exposition, possesses some of the world's best facilities for a large, *heavy* show of this type. There are practically no obstructions; all except one exhibit area is at ground floor level; natural lighting is superb; there are many eating and refreshment facilities for the visitors. Brussels itself is an attractive, modernized city with an excellent new airport, good highways, a fine tram system but lacking in enough good hotels for an exposition of this size. Prices are comparable to United States for living expenses.

Traffic is heavy in the streets and you see a great variety of automobile makes. Since Belgium has no automobile industry of its own to protect, imports from the major automotive producing countries find a good market here with many U. S. makes in evidence. Gas at approximately 32 francs (64¢) makes the large American car somewhat a luxury; however, many are being used as taxi cabs.

5000th Student Enrolls in MEI Plant Course

The 5000th MEI student was enrolled in the registration of a group of 20 individuals from the Ohio Steel Foundry Co., Lima, Ohio. Counting down alphabetically brought forth the name of Mrs. Betty Patterson, the only woman enrolled in the Ohio Steel Foundry group.

The class is enrolled in MEI Course 1, Elements of Metallurgy. Acting as instructor for the group

Mrs. Betty Patterson

is N. R. Arant, Ohio State University graduate; sharing instructional duties are Robert L. Hilgert and John T. Lundin, metallurgists at Ohio Steel Foundry.

This is the 134th MEI extension class that has been organized since MEI began 4½ years ago. Industrial in-plant classes are becoming increasingly popular and approximately one-third of all MEI students enroll in in-plant training programs, such as the one being offered at the Ohio Steel Foundry. MEI offers detailed assistance to companies who wish to arrange for a class on their own premises.

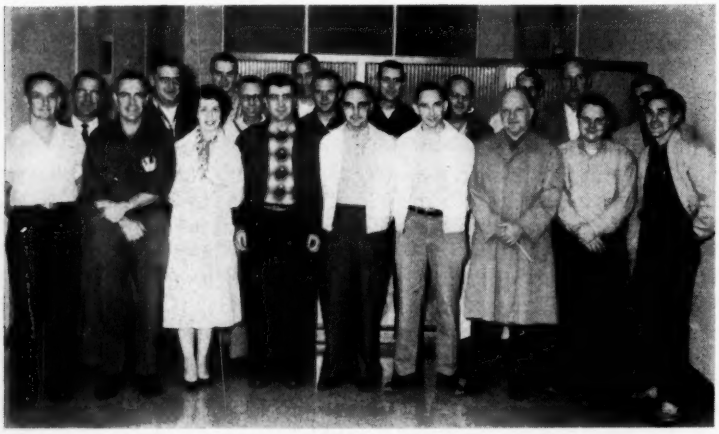
Mrs. Patterson, MEI's 5000th registrant and 23rd female student, is secretary to John M. Dugan, vice-president of operations at the company. Mrs. Patterson has been closely associated with many metallurgical activities of the company during the past ten years. She has actively participated in the preparation of many technical reports and the development of a technical library.

After completing MEI Course 1, Elements of Metallurgy, Mrs. Patterson expects that she will be more efficient in the fulfillment of her duties. The remaining 19 registrants plan to follow with the MEI course on Heat Treatment of Steel. Betty will decide whether or not to go on with the second course after she completes the first one.

Students enrolled for the course (see picture) are:

Front Row, from left: Earl F. Dienstberger, process control inspector, steel melting; Walter E. Baney, reflectoscope operator, Inspection Dept.; Betty Patterson, executive secretary; William Patterson, process control inspector, forged rolls; Dean E. Swartz, superintendent, iron foundry; Dennis McGraw, process control inspector, steel melting; Joseph C. Stoll, Sr., chief chemist; Fred K. Zapp, Jr., process control inspector, steel melting; and Harold K. Jordan, engine lathe machinist.

Second Row, from left: N. R. Arant, forged roll metallurgist (instructor); Harold E. Mills, iron roll mold inspector; Edward E. Miller, expeditor, forged rolls; Joseph E. Stoll, Jr., openhearth, second helper; Ray L. Lowell, Jr., process control inspector, iron melting; John J. Seggerson, foreman, iron melting; and G. Robert Smith, chemist.



Third Row, from left: James L. Duckworth, chemist; Robert E. Keller, assistant plant engineer; James E. Bourk, process control inspector, steel melting; Paul E. Miller, inspector technician.

Persons absent when photograph was taken were: Paul V. Arnett, toolmaker; Harry P. Meyer, foreman, induction heat treating; Robert L. Hilgert, steel roll metallurgist (instructor); and John T. Lundin, iron roll metallurgist (instructor).

Reducing Gases in Steels

Two methods of reducing gases in steels, vacuum casting and the D-H process, were discussed by Joseph J. Oravec, assistant chief metallurgist, Duquesne Works, U. S. Steel Corp., and W. L. Finlay, director of research, Crucible Steel Co. of America, at a meeting of the **Pittsburgh** Chapter.

The experience of U. S. Steel's Duquesne Works with vacuum pouring of ingots was described by Mr. Oravec. In this method, the ingot mold is contained in a vacuum chamber evacuated to about 100 microns of mercury. As the metal stream hits the vacuum it explodes into minute droplets, releasing the contained gases. Hydrogen is the most important gas released, being reduced from about 4.3 to 0.8 ppm. Oxygen is reduced somewhat but nitrogen does not appear to be lowered.

In addition to having low over-all hydrogen content, vacuum cast ingots have a uniform composition as contrasted to air cast ingots which contain more hydrogen in the center than on the surface. Product from vacuum cast ingots is virtually insensitive to flaking; thus, heat treating cycles may be shortened. Test pieces have been water quenched without the formation of flakes. Perhaps the greatest advantage of vacuum casting is the uniformly high ductility obtained. Elongations of 50% are common.

The D-H unit being used at Crucible Steel's Midland Works was described by Dr. Finlay. This is a process by which a ladle of molten steel is degassed and alloyed by means of a vacuum vessel located above the ladle. A nozzle on the vacuum tank is inserted into the metal and sucks a 57-in. head of molten steel into the vessel. Here vacuum conditions degas the melt. The D-H vessel is moved up and down three times a minute to pro-

mote agitation and suck new steel into the tank. About 30 cycles are needed to degas a ladle. Alloying elements are then often added by means of hoppers on the top of the tank. The turbulence encountered in the vessel insures good mixing.

Crucible believes the D-H process is the best degassing method for specialty steel manufacturers. All types of heats can be treated with close chemical control and low cost. Gases are descreased by the treatment, hydrogen being lowered from 4½ to 1½ ppm. Ductility, of course, increases commensurately. Open-hearth steel which has been D-H treated has the ductility of normal electric furnace steel. Microcleanliness is also improved. One steel had 0.012 wt. % inclusions before treatment but 0.006% inclusions after treatment.

Either vacuum pouring or D-H degassing gives many of the desirable results of vacuum arc melting without the prohibitively high costs. *(Reported by William G. Fricke, Jr.)*

Alpha Sigma Mu Chapters Formed at Three Colleges

The national honorary metallurgical fraternity, AΣM, originally formed on the campus of Michigan College of Mining & Technology in 1932, has just formed its 9th, 10th, and 11th chapters at Case Institute of Technology in Cleveland, University of Alabama at Tuscaloosa, and

Alpha Sigma Mu Key

Rensselaer Polytechnic Institute at Troy, N.Y.

Previously formed Chapters are at: University of Illinois, Virginia Polytechnic Institute, Missouri School of Mines, Wayne State University, University of Maryland, New York University and Brooklyn Polytechnic Institute.

Membership in Alpha Sigma Mu is restricted to metallurgy students of sterling character whose academic standing places them in the upper 25% of their class.

In its 29 years of existence, Alpha Sigma Mu has grown to 1072 members, and its growth has been unusually strong during the past two years.

Although chapters exist at only 11 campuses, metallurgy faculty from 23 other schools are regularly bringing outstanding metallurgy students, undergraduate and graduate, to the attention of the Board of Trustees which reviews their qualifications and vote on their election into the honorary metallurgical fraternity.

A sketch of the Alpha Sigma Mu key, showing an isothermal transformation diagram of eutectoid steel, was selected because it represents the major step forward in transforming steel heat treatment from an art to a science. The Greek letters, Alpha, Sigma and Mu, by the way, represent the Arts and Science of metals.

"INFAB" Facility Described

"INFAB—an Inert Atmosphere Refractory Metals Fabrication Facility", was the subject of a talk presented by Peter Rossin, general manager, Refractomet Division, Universal-Cyclops Steel Corp. at a meeting held recently by the **Washington** Chapter.

Within the last decade, the Department of Defense weapons systems programs has required the expeditious development of materials in order to support the functional requirements of the various vehicles and systems under consideration. Prominent in this materials development area has been research, development and production of mill products and components of refractory metals.

The elevated temperature properties of commercially pure refractory metals are sufficiently improved over that of steels and iron and nickel-base high-temperature alloys that they are of interest in their unalloyed form. Through selective fabrication and heat treating techniques, it is possible to provide mill forms of the commercially pure or binary alloys of the refractory metals.

However, the production processes now in use are, at most, poor compromises between the metallurgical requirements of the materials and the capabilities of facilities available.

Mr. Rossin pointed out that metallurgists are now at the point where they cannot continue to make such compromises. The requirements of weapons systems have extended environments to which materials will be subjected and an entirely new concept of design engineering relative to materials is coming into being.

These design requirements have fostered extensive alloy research programs directed towards the development of more complex refractory metals and their alloys which will permit application of materials at strengths and temperatures higher than anticipated a few short years ago.

To supply these materials, it is evident that specialty steel mills and their associated facilities are no longer adequate to produce the more promising refractory metals and alloys required.

A new facility at the Universal-Cyclops' Bridgeville plant has been placed in operation, which, for the first time, will enable metallurgists to consider processing all metals at their true hot working temperature within inert atmospheres.

This facility, "INFAB", was conceived by engineers of Universal-Cyclops and the Department of the Navy, Bureau of Naval Weapons.

INFAB is a welded steel enclosure, 42 ft. wide x 97 ft. long x 23 ft. high, filled with high purity (99.995%) argon gas. Located within this unique facility are remotely controlled rolling and forging equipment which will permit fabrication, at temperatures up to 4500°F., of mill products on a semi-production basis. Although controls for the equipment are outside the room, it is necessary to have one or two operators in the room to take care of any emergencies which might arise. These operators utilize special, protective clothing, resembling modified space suits, which contain waste products from the body and supply life support.

Sheet products up to 30 in. and bar products 3 in. in diameter and smaller, together with simple forgings, are considered potential products of this new facility. *(Reported by Roy M. Gustafson)*

It was National Officers Night as Cleveland Chapter met at Metals Park. Examples of continuous castings slated for the Materials Application Center at Detroit are examined by Allan Ray Putnam, managing director, Carl E. Swartz, then vice-president ASM, and the Cleveland Chapter chairman

Scenes as Cleveland Chapter Meets at Metals Park

. . . A time for getting together in the ASM cafeteria, renewing friendships, sharing ideas and information. This is the spirit of ASM and a scene that repeated 118 times a month all over North America

History of ASM is symbolized in the faces of its 43 past presidents in the Board of Trustees room, being pointed out by Allen G. Gray, editor, Metal Progress

Members taking a walk through Metals Park. Lew Berger, ASM/MEI training supervisor, points to the geodesic dome through the glass curtain walled garden on the plaza level

Aerospace materials and components for the Materials Application Center attracted great interest. Joseph Foster, Metal Progress associate editor, center, was one of the staff associates on hand

One of the things to see at Metals Park is the stainless steel ASM monogram studs in the table in the Board Room

Second Largest Metallographic Exhibit Attracts 1000's at Detroit Metal Show

On Oct. 23, when the doors of Cobo Hall swung open and the Metal Exposition started, a prime attraction was the 15th Annual ASM Metallographic Exhibit. On view were more than 350 of the finest engineering photographs ever made. (This number is second only to the 500+ submitted at the second World Metallurgical Congress held in Chicago in 1957).

Grand Prize Selected

Selected for the Francis F. Lucas Award and Grand Prize of $500 was an electron micrograph which illustrated the hardening mechanism of a nickel-base alloy containing 4.5% Al and 3.5% Ti. According to the description included with the picture, "large islands of gamma prime formed in 100 hr. at 1900° F. show a second carbide phase when treated an additional 16 hr. at 1400° F. The gamma-gamma prime interface shows a hexagonal structure". Winners of the Lucas Award were Prof. John F. Radavich of Purdue University and W. Couts, Jr., of General Electric Co. The research which produced this excellent example of micrography was described in a paper presented at an ASM technical session on "Space Age Metals" on Thursday, Oct. 26.

The complete list of 37 winners of "Best in Class" and "Honorable Mentions" in 14 categories is tabulated below. The entries this year, which included macrographs and micrographs (both colored and black and white), emphasized the ever-more prominent position that materials are achieving in today's industrial world. Along with extremely fine illustrations of the structural aspects of traditional metals—iron, aluminum, copper and the like—a large number of participants submitted photographs of cermets, ceramics, dispersion-hardened composites and other less-familiar materials.

Year of the Pyrolytic Graphite

Pointing up this "new frontier" in metallography was the remarkable ingenuity that many of the exhibitors displayed in devising ways to show striking structures of pyrolytic graphite. It could almost be called, the judges suggested, "the year of the pyrolytic graphite". When the final returns were in, 9 of the 14 categories included one or more pictures of this material.

It's a Big Job to Get Together

For those not familiar with the immense amount of work involved in assembling such an impressive display as the ASM Metallographic Exhibit, a brief outline of the preliminary steps which led to the judges' final selections may be of interest. In June, *Metals Review* published the first announcement asking for entries to the 1961 exhibit. Included with this full-page notice was a list of the 14 categories along with directions as to the manner of identifying each photograph. Displays gradually accumulated until the deadline date, two weeks before the Metal Show was to start. On Wednesday, Oct. 18, the real work began in Detroit. The 356 entries were unwrapped and numbered; a card record was typed, along with a duplicate gummed tag for each entry, including name and business connections of the metallographers, as well as the number and class of each entry. After sorting into categories the problem of mounting and placing 24 display boards in an area designed for half the number of entries had to be solved. Some 30 hours, six smashed fingers and four bunions later, all entries were mounted and ready to be examined by a previously chosen group of judges.

Judges Work Hard Too!

These judges, three highly qualified metallographers, arrived early Saturday morning and began to prowl slowly through the ranks of photographs. Examining each one carefully in relation to the others in the same classification, they first decided upon "Best in Class" and "Honorable Mention" awards. All entrants remained anonymous until the final choice of the grand prize just as the lights went out in Cobo Hall at 5:00 p.m. The last step was to paste the 356 labels so that the contributors could be identified.

Come to New York

Only those who attended the Metal Show in Detroit can possibly realize what a job the judges had—and what a job they did. Between now and next year's exhibit at the Metal Show in New York, however, the prize winners will be sent on tour to ASM chapters and universities, thus encouraging another good show.

Award Winners

Lucas Award and Grand Prize

John F. Radavich
Physics Dept.
Purdue University
and
W. Couts, Jr.
General Electric Co.
Cincinnati, Ohio

Class 11—Electron Micrographs Using Replicas
"Gamma Prime Particles in a Nickel-Base Alloy"

Class 1
Irons and Steels, Cast and Wrought

Honorable Mention: Claude Belleau and Donald H. Mott, Chrysler Corp. "Sub-Critical Graphitization of Armco Iron"

Honorable Mention: Charles A. Monroe, Detroit Testing Laboratory, Inc. "Stress Corrosion in Structural Steel"

Class 2
Stainless Steels and Heat Resisting Alloys

Honorable Mention: L. Dillinger, D. C. Ludwigson and R. D. Buchheit, Battelle Memorial Institute. "Microstructures of N155 Alloy"

Class 3
Aluminum, Magnesium, Beryllium, Titanium and Their Alloys

Best in Class: R. R. Russell, General Electric Research Lab. "Alu-

1961 ASM Metallographic Award Winners (continued)

minum+13% Silicon, As-Cast Thin Section"

Honorable Mention: James R. Dvorak, Armour Research Foundation. "Titanium-Oxide Plus 15% ZrO_2, As-Cast"

Class 4
Copper, Nickel, Zinc, Lead and Their Alloys

Best in Class: W. A. Roman, General Electric Research Lab. "Copper-Oxygen Eutectic Colonies With Pro-Eutectic Cuprous Oxide"

Honorable Mention: Mrs. T. V. Brassard, General Electric Research Lab. "Nickel-Boron Alloy, Ni-Ni_2B Eutectic in Nickel Matrix"

Class 5
Uranium, Plutonium, Zirconium and Reactor Fuel and Control Elements

Best in Class: W. J. Gruber, General Electric Co., Hanford Atomic Products Operation. "Irradiated Plutonium Aluminum Alloy"

Honorable Mention: Cecil G. Rhodes, Atomics-International. "Uranium-Dicarbide in a Matrix of Uranium Monocarbide"

Honorable Mention: C. K. H. DuBose and R. J. Gray, Oak Ridge National Lab. "Uranium-Carbide Spheres Coated With Pyrolytic Graphite"

Class 6
Metals and Alloys Not Otherwise Classified

Best in Class: James A. Nelson and Robert G. R. Johnson, Westinghouse Electric Corp. "Rapid Freezing of Co-Sb-In-Te Alloy"

Honorable Mention: William C. Coons, Lockheed Missile and Space Co. "Tungsten and Tungsten-Carbide Powders"

Honorable Mention: R. R. Russell, General Electric Research Lab. "Columbium-Zirconium Alloy Showing Eutectoid Structure"

Class 7
Series Showing Transitions or Changes During Processing

Best in Class: J. P. M. Faessen, Philips Research Labs, Eindhoven, Netherlands. "Austenitic Grain Growth in 0.45% C Steel"

Honorable Mention: Robert F. Dragen, Armour Research Foundation. "Effects of Added Aluminum in Ti-20% Cb Alloy"

Class 8
Welds and Other Joining Methods

Best in Class: Alex E. Wituszynski, Knolls Atomic Power Lab., General Electric Co. "Diffusion Bond in Butt Weld of Zircaloy-2 and Hafnium"

Honorable Mention: William C. Coons, Lockheed Missile and Space Co. "Brazed Joint Between Two Pieces of Pyrolytic Graphite"

Class 9
Surface Coatings and Surface Phenomena

Best in Class: F. E. Alberts, Ford Motor Co. (Printing by Robert Benoit). "High-Purity Iron Thermally Etched"

Honorable Mention: W. Hughes, D. Stiles and M. Stratis, Westinghouse Research Labs. "Preferential Oxide Attack at Grain Boundaries"

Honorable Mention: Mrs. T. V. Brassard, General Electric Research Lab. "Pyrolytic Graphite Deposit on Tungsten Wire"

Class 10
Slags, Inclusions, Refractories, Cermets and Aggregates

Best in Class: R. R. Russell, General Electric Research Lab. "As-Cast Columbium-Oxygen Alloy Showing Dendritic Cbo_2 Structure"

Honorable Mention: E. R. Amsden, R. H. Jameson and R. D. Schubert, Lockheed Missiles and Space Co. "Deformation Bands in Pyrolytic Graphite"

Class 11
Electron Micrographs Using Replicas

Grand Prize: (See box, p. 14)

Honorable Mention: John F. Radavich, Purdue University. "TiC Particles in Incoloy 901"

Honorable Mention: Vincent M. Poynter, General Electric Flight Propulsion Lab. "Adherent Oxides on René 41"

Honorable Mention: Thomas P. Turnbull, M.I.T. Lincoln Lab. "Indium Antimonide—Movement of Small Dislocation About a Large Pit"

Class 12
Electron Micrographs (Transmission)

Best in Class: Victor A. Phillips, General Electric Research Lab. "Dislocation Lines in Molybdenite"

Honorable Mention: Angeline Fourdeux, European Research Assoc. S.A., Brussels, Belgium. "Dislocation Lines and Etch Pits in Columbium"

Honorable Mention: A. M. Turkelo, General Electric Research Lab. "Slip Band Dislocation Structure in Silicon-Iron"

Honorable Mention: Erwin Votava, European Research Assoc. S.A., Brussels, Belgium. "Polygonization in Molybdenum-48% Rhenium Alloy"

Class 13
Color Prints in Any of the Above Classes

Best in Class: R. E. Powel, J. J. Campbell and J. C. Gower, Oak Ridge National Lab. "Single Crystal of Tantalum Oxidized at 500° C."

Honorable Mention: W. H. Powers and R. H. Mills, U. S. Steel Corp. Applied Research Lab. "Pyrolytic Graphite on Refractory Brick"

Honorable Mention: R. H. Jameson and R. D. Schubert, Lockheed Missiles and Space Co. "Deformation Bands in Pyrolytic Graphite"

Honorable Mention: L. G. Shrader, E. P. Griggs and R. S. Crouse, Oak Ridge National Lab. "Single Crystal of Columbium With Oxide Surface Layers"

Class 14
Results by Unconventional Techniques

Best in Class: John W. Lenke, Armour Research Foundation. "Qualitative Microprobe Analyses of Iron-Tungsten Powder Composite"

Honorable Mention: D. M. Olson, Los Alamos Scientific Lab., University of California, and Paul H. Anderson, South Dakota School of Mines and Technology. "Microstructure of Columbium at 3270° F.

Honorable Mention: William C. Coons, Lockheed Missile and Space Co. "Microhardness Tests of Pyrolytic Graphite"

1961-1962 ASM Officers Elected at Annual Meeting

Five new national officers and trustees of the American Society for Metals were elected during the 43rd National Metal Congress, Oct. 23-27, in Detroit's Cobo Hall. The new trustees represent many aspects of metalworking and materials industry, science, education and research. Elections were held at the 43rd ASM Annual Meeting, Oct. 25, and became effective immediately following the Metal Congress.

Carl E. Swartz, nationally known consultant in metallurgy and materials, is president of the 34,000-member Society which serves the metals, materials and process engineering industries. Advancing from vice-president, Dr. Swartz has been active in ASM for more than 27 years. He was also a national trustee, 1956-1958. He has a broad range of interest and knowledge in the materials field. He operates a consulting service from offices in Hinsdale, Ill. His specialized knowledge of metals, metal joining, production and casting are enhanced by his long-standing interest in nonmetallic materials — plastics, ceramics, glass fibers and glass.

Dr. Swartz brings to the ASM presidency vital enthusiasm for materials and the application of advanced technology to the problems of today. "ASM's most important role in our society", he states, "is to make a major contribution toward continuing educational progress of the metals and materials industry at all levels—the operator, the engineer, the research scientist and the manager".

Dr. Swartz has been a leader in four of ASM's 118 chapters. He served on the executive committees of the Cleveland, Washington and Chicago Chapters and was Cleveland Chapter chairman, 1941-1942. After moving to Hinsdale, he became actively interested in meeting the need for an ASM chapter to serve Chicago's West Side suburban area. He was instrumental in the formation of such a chapter, the Chicago-Western Chapter, in 1954 and served as its first chairman, 1954-1956. He has devoted a great deal of time to the work of the Society's national committees. He was chairman of the Long Range Planning Committee and member ex-officio of a number of subcommittees. He was a member of the Nominating Committee in 1943 and the *Metal Progress* Advisory Committee from 1944 to 1946. Prior to his term as vice-president, he served as a member of the ASM Board of Trustees, 1956-1958.

Robert J. Raudebaugh, national treasurer last year and former trustee of the Society, succeeds Dr. Swartz as vice-president. He is a 27-year member of the ASM. Dr. Raudebaugh has held important posts in industry and education, and now is supervisor of iron-nickel alloys for International Nickel Co., New York. He has authored several technical papers and a book, "Nonferrous Physical Metallurgy".

Joseph Gray Jackson, embarking upon a two-year term as national treasurer, is undoubtedly the first patent attorney to hold office in ASM. He is a partner in the Philadelphia law firm of William Steell Jackson and Sons, and for 18 years has been active as chairman and member of many local and national ASM committees. In addition to his extensive background in law, he is a registered professional engineer, metallurgical, in Pennsylvania.

John A. Fellows, also beginning a two-year term as national trustee, is assistant technical director, research and development, for Mallinckrodt Chemical Works, Uranium Div., St. Charles, Mo. An outstanding nuclear metallurgist, Dr. Fellows has been active in St. Louis Chapter and its 1961-1962 chairman.

John W. Sweet, also a new trustee, is chief metallurgist for Boeing Airplane Co.'s Aerospace Div., Seattle, where he specializes in metallurgical research and development for airborne, space, ground support and marine vehicles. He has held top offices in ASM's Puget Sound Chapter and has been unusually active in national committee and conference work for the Society.

President Carl E. Swartz (left) takes time out from his official duties to discuss technical developments with other visitors at the Detroit Metal Show

Several present officers and trustees are continuing for the 1961-1962 year. *William A. Pennington,* immediate past president, is serving a one-year term as trustee. *Merrill A. Scheil* begins the second of a two-year term as secretary. *Morris Cohen* and *John Convey* are completing two year terms as trustees.

Retiring from the Board of Trustees is past president *Walter Crafts,* who has served for seven years in various national offices. Also retiring are national trustees *Albert R. Fairchild* and *Carl H. Samans.* These three men were honored during the Annual Meeting for their outstanding service to the Society.

Robert Freeman Named to ASM Information Searching Staff

Robert D. Freeman has been appointed business manager of the American Society for Metals' newest and most advanced service to metalworking, the ASM information Searching Service, according to an announcement by Allan Ray Putnam, managing director of the Society.

The appointment is a further step in gearing this fully automated literature searching service to meet industry's demand for accurate information with electronic speed.

Freeman joins ASM after 14 months as executive secretary of the Ohio Scholarship Funds, Columbus. He was director of public in-

Robert Freeman

formation for Western Reserve University, Cleveland, during the formative years of the Documentation Service, developed by that school's Center for Documentation and Communications Research under the sponsorship of the ASM.

Freeman brings a broad academic background to ASM. He served for five years as alumni secretary at Mount Union College, Alliance, Ohio, from which he received a B.A. degree in 1948. He earned a M.A. degree from the University of California, Los Angeles, in 1950, and served for one year in the Bureau of Governmental Research at that University.

Freeman will counsel leaders in industry and research, stressing the effective means of solving specific information problems through electronic searching of technical literature. The ultra-new General Electric GE-225 "electronic librarian", focal point of the service, is now installed at the Searching Center in Cleveland, and is capable of running a virtually unlimited number of high-speed searches in response to questions on specific subjects.

Subscribers may now obtain up-to-the-minute information on anything published in their field of interest, within scant weeks of publication. Every two weeks they will receive such information published during the preceding two weeks.

In addition to its time and cost saving features, electronic information searching is completely thorough. Its scanning is primed to pick up even the slightest reference to a desired subject. And, because it is so current, it is making significant contributions in the reduction of the critical "time lag" between conception of an idea and its use.

A native of Canton, Ohio, Freeman presently resides there with his wife Betty and five children. He has participated in a number of civic activities and professional organizations.

Four Chapters Earn President's Cups

Four ASM chapters, one in each of four size groups, were awarded cups at the annual Awards Dinner on Monday, Oct. 23, during the National Metal Congress. The awards, made by Dr. William A. Pennington, ASM President, were for outstanding membership growth during the period from Jan. 1, 1960, to Aug. 31, 1961.

Winners were: Very Large Chapters (over 600 members), *Los Angeles* with an increase of 233 members or 20.4% over the starting membership: Large Chapters (300 to 600 members), *St. Louis* with 67 new members for a 21.8% increase: Medium Sized Chapters (141 to 300 members), *Wilmington*, recording a 41.5% increase represented by 59 new members: Small Chapters, *Upper Ohio Valley* which increased its membership by 3.5 times by adding 153 new members.

Runner-up in the very large chapter group was *Milwaukee* with a 15.4% increase. In the large-size chapter group, several chapters were in the running for the award until the final period of the competition. *Chicago-Western* grew by 20.4%, *Long Island* by 20.1% and *Golden Gate* by 19.4%.

In the group of medium-size chapters there were also several outstanding performers. For example, *Oak Ridge* had a 36.3% increase; *Santa Clara Valley* recorded a 31.0% growth to barely lose out to *San Fernando* which grew by 31.1%. *British Columbia* also exceeded 20% growth with 23.2.

Fourteen chapters in the smallest category, in addition to Upper Ohio Valley, had membership growth of more than 20%. The chapters and the percentage of increase are: *New Hampshire*, 59.6%; *Bonneville*, 48.9%; *Sacramento Valley*, 39.2%; *Des Moines*, 32.4%; *Albuquerque*, 37.6%; *Southeast Ohio*, 36.2%; *Inland Empire*, 28.8%; *Medicine Hat* and *Atlanta*, 28.2%; *Utah*, 26.4%; *Manitoba*, 26.0%; *Cedar Rapids*, 25.3%; *Alberta* and *Ottawa Valley*, 23.9%; *Los Alamos*, 23.5%; and *Sangamon Valley*, 21.1%.

Of the 115 chapters in existance at the start of the competition, 91 gained members, 2 neither gained nor lost, and 20 showed membership decreases.

MEI One-Week Courses Succeed

A new concept in ASM educational techniques was tried this past summer with remarkable success. The presentation of the entire Metals Engineering Institute course, "Principles of Heat Treating", in one concentrated week was well received in Philadelphia (June), Pittsburgh (August), Dearborn, Mich. (August), and Wallingford, Conn. (September). Instruction was presented by Anton deS. Brasunas, MEI director, and Lewis W. Berger, MEI training supervisor. A special feature was an afternoon Panel of Experts session in which registrants were given an opportunity to discuss their heat treating problems with local experts.

Registrants were enthusiastic in their praise of the course and the effectiveness of the one-week presentation. As one registrant commented, "I came here for a review and was startled to find that I was learning something new".

The intensive one-week MEI course in "Principles of Heat Treating" is the same course that is ordinarily covered in 4½ months when taken as a chapter or industry-sponsored course, or consuming an average of about 10 months when taken as an individual home study course.

Allan Putnam, managing director of ASM, is enthusiastic about

Rossi, Remington Rand Shaver Division; James McArdle, Pitney-Bowes, Inc.; and Welsford Bryan, Singer Manufacturing Co., and front row: Lew Berger, MEI training supervisor: Howard Farr and Art Youland, Hyde Windless Co.; Monte Misiti, Pitney-Bowes, Inc.; Ed Cordial, Kolene Corp.; Al Membrino, Saxton Trade School; and Vince Zolkiewicz, Detroit Steel Corp.; absent from the photo is Robert Germain, Wallingford Steel.

this mode of MEI course presentation and feels that it should be continued. Present plans call for a repeat performance. During the coming 1962 year, however, the courses will not be limited to the summer months as they had been in 1961. The tentative schedule for the coming year is:

Mar. 1-7—Birmingham, Ala.
Apr. 19-25—Cleveland, Ohio
June 21-27—Ontario, Canada
Sept. 13-19—Western or Southwestern location

Included in the busy six-day schedule are two evening sessions, several films, demonstrations, intensive formal discussions, study of microstructures, an exhaustive treatment of hardenability—all this and more, sprinkled with good fellowship.

The concentrated 1962 courses will be presented using the proven "split week" idea which was so well received at Dearborn, Mich. The one-week classes will begin on Thursday morning at 8:30 a.m. and continue to Wednesday evening. Although classes will be scheduled for Saturday, Sunday is a day off from the academic routine. During the 1961 season, classes were held at quiet suburban inns and motor lodges. This same procedure will continue.

Reservations for the 1962 classes are now being received; again the number of registrants per class will be limited. Further details concerning the one-week intensive training course on "Principles of Heat Treating" may be obtained by writing directly to MEI Headquarters, Metals Park, Ohio.

Shown in the photo are the registrants at the class held in Wallingford. This particular class was filled to capacity and some applicants were actually turned away. Participants were, back row: Don Lehnacker, Bowsteel Distributors Corp.; Harry Spooner, Rico Machine Co.; Matt Mirantz, Special Chemicals Corp.; Bill Soltes, Hepenstall Co.; William Sansom, Omark Industries, Ltd.; Wilfrid Taylor, New England Metallurgical Corp.; Axel Granered, Uddeholm of America; Richard Vossler, Hevi-Duty Electric Co.; Lionel Cinamon, Special Chemicals Co.; Carl Anderson, U. S. Naval Underwater Ordnance Station; and Irving Block, Greenfield Tap and Die Corp., middle row: Tone Brasunas, MEI director; John Moran, Quartermaster Research and Engineering Center; James Kurt, Bowsteel Distributors Corp.; Albert Winters and Ed

NEW BOOKS

Theory of Metal Cutting. Paul H. Black. McGraw-Hill, 330 W. 42nd St., New York 36, N. Y. $7.50.

Thermoelectricity—Science and Engineering. R. R. Heikes and R. W. Ure, Jr. Interscience Publishers, 250 Fifth Ave., New York 1, N. Y. $18.50.

Uranium Carbides — Bibliography. H. H. Hausner and Helen Friedemann. Metallwerk Plansee Artiengesellschaft, Reutte/Tyrol, Austria.

X-Ray Absorption and Emission in Analytical Chemistry. Liebhafsky, Pfeiffer, Winslow and Zemany. John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $13.50.

Year Book of the American Bureau of Metal Statistics. 40th Annual Edition. American Bureau of Metal Statistics, 50 Broadway, New York, N. Y. $4.

REPRESENTATIVE OF YORK CHAPTER *sustaining members present at a meeting during which Carl Zapffee spoke on "Science, Religion and World Events", include, front row, from left: N. L. Hammond, Peter A. Frasse Co., Inc.; D. G. Livingston, Hill-Chase Co.; F. N. Hull, Universal Cyclops Steel Corp.; and Carl A. Tenhoopen, Jr., U.S. Steel Supply Div. In the back row are, from left: J. W. Reckard, Horace T. Potts Co.; E. L. Williams, Fairchild Aircraft; J. W. Drexler, Edgcomb Steel Co.; and Thomas Dougherty, Bearings Co. of America*

NINE LIFE MEMBERS *of the Chicago Chapter who were guests at a recent meeting include, from left: E. J. Gossett, W. R. Mau, H. L. Campbell, A. T. Clarage, E. T. Jackman, E. L. Roff, H. B. Knowlton, A. J. Boynton and E. W. Pierce. There are 25 life members of the Chapter. To qualify, they are over 65 years old and have 35 or more years of continuous service, or are over 70 and have 20 or more years of continuous service*

Ontario Plans for the Ladies

Ladies Night at the ASM does not indicate that the gals are getting technical—it means the guys of the **Ontario** Chapter are indulging in a pleasant evening of wine and song with their wives and sweethearts. However, it is not only a fun time, but an income raiser for the Chapter which has scholarship commitments at four universities. Here is how the Chapter plans for the evening.

One of the executive committee members is made chairman—a $6000 party for 700 people requires considerable planning and work to be a smooth-running affair.

A budget is first prepared, along lines developed over past years of experience, and an estimate of costs, receipts and profit made up. Timing of planning arrangements is adhered to strictly. The night is always the first Friday in March. The orchestra and floor show are booked by the end of November and the menu finalized by the end of January so that a copy of the souvenir menu and program can be mailed with the regular program announcement during the first week of February. A request for draw prize donations is sent to a selected list from the sustaining as well as certain regular members. Cash or prizes up to a value of $25 are received, the cash is converted to prizes and about 70 are collected and gift wrapped. A letter of thanks goes to each donor. The treasurer, who is also the ticket controller, sends tickets to a selected group of "salesmen", and the names and company addresses of these salesmen are printed on the program.

To defray the expenses of the program announcement and the bar, three sponsors are obtained from the sustaining members. They receive advertising space in the announcement and signs recognizing them as hosts are put up at the bar. There is no charge made for the drinks. Finally, the night arrives. From the time the bar opens prior to dinner, until the dancing starts, a time schedule is tightly maintained. In sequence, there is a "goodwill" hour at the bar, dinner, introduction of head table but no speeches, drawing and giving out of prizes, one-half hour of entertainment and dancing. If the planning has been done well, everyone goes home happy after another successful Ladies Night. *(Reported by J. R. Beale)*

MEMBERS OF COLUMBUS CHAPTER'S *Executive Committee (1961-1962) include, front, from left: C. G. Fosnaught, treasurer, S. H. Ziegler, vice-chairman, E. M. Sherwood, chairman, R. E. Christin, 25-year secretary, and A. M. Federico, immediate past chairman. In second row, from left, are: R. F. Marande, Paul Lockwood, Paul Frost, R. M. Berry and P. O'Reilly*

EMPLOYMENT SERVICE BUREAU

Operated on a no-charge basis for A.S.M. members in good standing. Ads are limited to 50 words and only one insertion of any one ad. Address answers to: Box No., American Society for Metals, Metals Park, Ohio, unless otherwise stated.

POSITIONS OPEN

East

RESEARCH METALLURGIST: Immediate opening for graduate metallurgist to conduct experimental research and head up small research group. Preferred applicant would have 5-10 years experience with nonferrous alloys, especially the low melting metals and their alloys. Our organization offers modern research facilities in the Delaware Valley area. Please send detailed resume, photograph and salary requirements. Box 11-5.

ASSISTANTSHIPS: Graduate research assistantships and post-doctorate fellowships available in metallurgy, starting immediately. Contact: James A. Luker, Chairman, Dept. of Chem. Eng. and Met., Syracuse University, Syracuse, N.Y.

Midwest

MELTING SUPERINTENDENT: Foundry specializing in stainless steel and high-alloy castings needs top caliber, young, aggressive working executive with minimum of five years experience in metal melting. Salary open to negotiation. Send resume to: Stainless Foundry & Engineering, Inc., 5132 N. 35th St., Milwaukee 9, Wis.

ASSISTANT METALLURGIST: Opening as assistant metallurgist for large manufacturing plant in Indianapolis area. Requirements are B.S. in metallurgical engineering, plus three or more years experience. Salary commensurate with experience. Box 11-10.

West

ALUMINUM METALLURGIST: Large national company, progressive in metals, has opening for plant metallurgist. Should have experience in fabricating of aluminum products, particularly extrusions. Location in Southern California. Box 11-15.

METALLURGIST: Nonferrous process control. Major aluminum fabricator and processor of exotic metals. Prefer degree and one or two years aluminum experience. Attractive residential area. One hour drive to ocean, mountains, desert, and Los Angeles. Box 11-80.

POSITIONS WANTED

ENGINEERING SALES: B.S. in metallurgical engineering, Case Institute. Industrial sales experience, familiar with ferrous and nonferrous metals. Prefers Cleveland base but will travel. Resume on request. Box 11-20.

METALLURGIST OR METALLURGICAL ENGINEER: B.Met.E. degree, age 27, married, veteran. Desires production or quality control work in metal processing industry. One year experience in materials and processes engineering with leading aircraft company. Box 11-25.

CANADIAN METALLURGIST: B.A.Sc. degree, with extensive experience in sales and market development of welding products, stainless, nickel alloys and carbon steel. Wishes to locate with U.S. company. Has held managerial positions and is conversant with pulp and paper, furnace, wire and welding fields, etc. Age 44. Box 11-30.

METALLURGICAL MANAGER: B.S. degrees in chemical engineering and physics, age 42, married. Eighteen years experience in steel foundry and construction equipment. Presently in charge of large metallurgical department. Also functions as assistant to plant manager doing staff work on numerous management problems. Seeks challenging management job. West or Southwest location. Box 11-35.

METALLURGIST: B.S. degrees in physics and metallurgy, age 31, married, 6-7 years experience in investigation of failures, metallography, creep, stress-rupture, fatigue and other physical and mechanical testing, materials evaluation, research and development of ferrous and nonferrous alloys including stainless steels, heat resistant alloys used in aircraft industry. Box 11-40.

METALLURGICAL ENGINEER: Age 38, M.S. degree with ten years diversified experience in alloy development and materials application and thorough practical background in high-temperature alloys, steels and nonferrous metals, desires responsible position of challenging nature with growth potential. Box 11-45.

METALLURGICAL ENGINEER: M.S. degree, age 35, family. Ten years experience in aircraft industry including alloy development, failure analysis, corrosion prevention, mechanical properties evaluation, heat treating, last three years as assistant supervisor of materials and processes laboratory. Desires position in development or research. Present location California but will relocate. Box 11-50.

POWDER METALLURGIST: Over 25 years experience in ferrous and nonferrous. Graduate metallurgical engineer. Experience in production of metallic powders to production of finished parts. Research and development on vacuum sintering, refractory, cermets and magnetic materials. Sales experience in metallic powders, porous metal bearings and metal parts in Midwest area. Box 11-55.

METALLURGICAL ENGINEER OR METALLURGIST: Age 42, family, B.S. degree, 11 years of diversified experience in supervisory and technical capacity in nonferrous metal production, both smelting and refining. Resume upon request. Available immediately. Box 11-60.

PLANT SUPERINTENDENT: Five years plant superintendent, vacuum induction melted superalloy, 12 years chief metallurgist aluminum, magnesium and iron foundry. Extensive experience in all phases of foundry and casting industry. Considerable experience in technical phases of customer relations. College graduate, publications, age 45. Resume on request. Available immediately. Box 11-65.

METALLURGIST: Age 34, married, family, degree. Nine years experience in development, research, processing, control, testing, diversified fields. Recent powder metallurgy customer development and specification work. Three years in steel mill, three years in aircraft and bearings industries. Versed in all phases heat treating. Desires challenging position. Resume available. Will locate anywhere in U.S. Box 11-85.

SALES MANAGER: With 14 years experience with reputable steel service center. Proven sales record. Experienced in training inside and outside sales personnel. Experienced in carbon bars, sheets, plates, structurals, toolsteels, alloys and stainless steels. Metallurgical diploma. Desires position in East. Resume on request. Box 11-90.

REFRACTORY METALS

Degree. 3 or more years experience in the fabrication or processing of molybdenum, tungsten, tantalum or other refractory metals. Leading firm. To $12,000. Contact K. J. Peifer.

tomsett associates inc.

Management Personnel Counselors
431 Frick Bldg. Gr. 1-2050
Pittsburgh 19, Pa.

RESEARCH DIRECTOR

Outstanding opportunity for a powder or physical metallurgist with development and production background. The company is an established manufacturer of bearings and is planning diversification into new areas. Responsibilities will include research and development on bearings as well as in areas proposed for diversification.

The man must have a sound education in fundamental metallurgy with in-plant experience in powder metallurgy. This is an excellent opportunity for an aggressive young man with ability who wants to grow with a progressive concern. Salary open. Location, Midwest. **Box 11-75, METALS REVIEW.**

METALLURGIST

Requires man about 35 with proven technical ability in stainless steel and super alloys. Facilities include air and vacuum induction melting. Strong background in chemistry required as responsibility would include supervision of chemical laboratory and X-ray Spectrograph.

CANNON-MUSKEGON CORP.
G. Cannon, Jr.
2875 Lincoln Street
Muskegon, Michigan

METALLURGISTS

Major aluminum producer desires Metallurgists for Control and Project work and for positions in Production Supervision. Experience in D. C. Casting and/or Extrusions desirable. Permanent position with liberal benefits.

Submit resume with salary requirements to:

BOX 11-70

METALLURGICAL ENGINEER

with 3-5 years experience for evaluation and development of metals for use by large glass company. Applicant should be familiar with metallographic techniques and foundry production methods. New laboratory is located 35 miles from Chicago in pleasant rural area. Salary commensurate with ability and experience. Write to **Mr. R. P. Eichhorn, Hazel-Atlas Glass Division, Continental Can Company, Research & Development Department, Plainfield, Illinois.**

YOU WILL GO FARTHER FASTER IN YOUR COMPANY AND IN THE METAL WORKING INDUSTRY WITH AN MEI* BACKGROUND

If you're interested in "moving up the ladder" in your present company . . . if you want to become part of the "decision-making" team in your organization . . . broaden your knowledge of the metal-working industry . . . improve your present position and income . . . NOW is the time to investigate the advantages of enrollment in ASM'S METALS ENGINEERING INSTITUTE. Today, MEI offers more than 20 courses in metals subjects ranging from "Elements of Metallurgy" to "Metals for Nuclear Power". These comprehensive and inexpensive courses prepared and compiled by noted specialists in the fields of materials and processes, can be taken at home under the watchful guidance of the expert MEI staff. The Metals Engineering Institute courses of *your* selection can be a major step forward to a rewarding career in the metal-working industry.

Here's what MEI graduates say about this educational program:

". . . excellent and I will eventually take every subject you offer"

". . . thanks to your fine course, I have become a department supervisor"

**METALS ENGINEERING INSTITUTE, an educational "function" of the American Society for Metals*

Here is a partial list of courses offered through MEI

Elements of Metallurgy
Heat Treatment of Steel
High Temperature Metals
Titanium
Copper, Brass and Bronze
Magnesium
Tool Steels
Arc Welding
Blast Furnace Operations
Metals for Nuclear Power
Stainless Steels
Electroplating and Metal Finishing
Gray Iron Foundry Practice
Oxy-Acetylene Welding
Steel Foundry Practice
Recovery of Lead and Zinc
Steel Plant Processes
Ferrous Metallurgy
Corrosion
Principles of Machining
Principles of Heat Treating

Please send me complete information and costs on courses offered by MEI.

Name _____

Company _____

Address _____

City _____ Zone ____ State _____

AMERICAN SOCIETY FOR METALS

METALS PARK, OHIO

the 3 minute glass

Metal Science Kit Is Now a Reality

For a long time Student Affairs Committees of the various chapters and committees concerned with attracting more high school students into metallurgy have been searching for some way of getting these students better acquainted with the field of metallurgy. Now I am glad to report to you that something has been done. We have just completed the preparation of a Metal Science Kit.

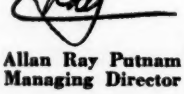
The Advisory Committee on Metallurgical Education was charged with the task of preparing a Metal Science Kit a year ago by the then newly elected president, William A. Pennington. His special instructions to Chairman Earl Roberts were to finish the assignment and have a kit on display at the 1961 Metal Show in Detroit.

With such a clear-cut goal, Earl immediately assigned the project to a committee under the chairmanship of Bill Collins of the Boston Chapter, together with Marc Richmond, graduate student at M.I.T., and numerous other individuals, whose names, unfortunately, cannot be listed here. A considerable amount of work, writing and experimentation went into testing various kit components until finally the job was completed. Closely following the progress of the committee and keeping in close touch with the ASM administration, the committee and the producer, Science Materials Center in New York, was Tone Brasunas of the ASM staff.

The Metal Science Kit, which was on display in Detroit in the ASM booth and shown to the Chapter Chairmen at the Monday Clinic Session, contains all the necessary specimens and raw materials to perform well over 100 scientific experiments. These range from the determination of a modulus of elasticity to tests involving Curie temperatures, corrosion resistance and numerous other experiments, which we feel confident will make high school students better aware of what metallurgy has to offer.

Like the chemistry and physics kits now available in department stores, the Metal Science Kit will also be distributed to the general public through department stores by Science Materials Center. Furthermore, ASM chapters may order kits for their own use through ASM headquarters at a special discount rate and use them in connection with their Student Affairs activity and contacts with local high schools. The Metals Science Kit can also be easily incorporated with the Future Scientists of America Awards Program, which ASM has been sponsoring for the past ten years (See "Three-Minute Glass", April 1961, *Metals Review*), the Boy Scouts and Explorer Scouts Program, and perhaps be used to set up special displays illustrating metal behavior at science fairs. There are undoubtedly many other ways in which these kits can be used to the benefit of the students as well as the metallurgical profession.

The Metal Science Kit is a wonderful accomplishment and the persons responsible for its preparation, those that I have named and those that I have not named, should be commended for a splendid job, which will undoubtedly have many long-range benefits to the field of metallurgy.



Allan Ray Putnam
Managing Director

SENIOR RESEARCH SCIENTISTS

Outstanding opportunities for scientists with Physical Metallurgy or Ceramics background interested in basic materials research. Responsible positions available for Ph.D's preferably with post-doctorate research experience.

Current group interests are in mechanical properties of crystalline and non-crystalline solids, including single and polycrystalline ceramics, refractory metals and plastics; oxidation mechanisms in metals; alloys for high temperature thermocouple purposes. *Write in confidence to: Dr. C. H. Li, Honeywell Research Center, Hopkins, Minn.*

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To explore professional opportunities in other Honeywell locations, coast to coast, send your application in confidence to Mr. H. D. Eckstrom, Honeywell, Minneapolis 8, Minn. All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

RESEARCH METALLURGISTS

Challenging, diversified research positions exist for non-ferrous metallurgists experienced in copper and aluminum base alloys. These assignments in the modern New Jersey Research Laboratory require a PhD or MS degree plus up to 5 years applicable experience.

Applicants should send complete resume to:
Director of Research
Dept. 30

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street
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Challenging opportunity to develop new methods for Metallurgical Analysis and evaluate electron microscope and X-ray diffraction studies. Job will include research into wide variety of metals problems (such as metal bonding) from other Research and Development Departments here at Princeton.

Master's Degree in Metallurgy with two years experience in Metallurgical Microscopy preferred.

Excellent Company benefits, including Tuition Refund Plan and Graduate Engineering Training Program.

Please reply in writing to:

Mr. J. V. McGuigan
Personnel Department
Western Electric Engineering Research Center
P. O. Box 900
Princeton, New Jersey

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Metallurgical operation requires man about 35 with sound technical training and proven managerial ability. Requires strong production experience in standard practices and standard costs. Facilities include air and vacuum induction melting of stainless steel and super alloys and complete chemical and mechanical testing facilities.

High earnings opportunity.

CANNON-MUSKEGON CORP.
G. Cannon, Jr.
2875 Lincoln Street
Muskegon, Michigan

X-RAY DIFFRACTIONIST

A broadening program of fundamental investigation provides an opportunity for an X-Ray Diffractionist to become a member of a team of electron-microscopists, metallurgists and physicists studying the structures of magnetic components in electronic computer development.

A BS degree including basic training in solid state physics, and experience in X-Ray Diffraction is the minimum requirement. Excellent opportunities exist for company sponsored graduate study at the University of Minnesota.

Salary commensurate with experience, relocation costs and liberal employee benefits. Qualified applicants should address inquiries with complete resume of education, experience and salary requirements to:

R. K. PATTERSON
REMINGTON RAND UNIVAC
Division of Sperry Rand Corporation
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(An equal opportunities employer)

OPPORTUNITIES WITH IBM'S COMPONENTS DIVISION

IBM's newly-formed Components Division has immediate openings for experienced engineers, mathematicians, physical scientists metallurgists, chemists and technicians qualified and interested in the following fields . . .

SOLID STATE DEVICES: Utilization of the methods and techniques of basic research to develop solid state semiconductor devices and integrated circuits devices for use in the improvement of computer reliability, flexibility, speed, capacity, etc.

Included is exploration into novel semiconductor phenomena and their potential application to devices.

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COMPONENTS ELECTRICAL ENGINEERING: Analysis design, fabrication and maintenance of measurement and test equipment for solid state components and integrated circuits. These will include the most advanced automated device testing and data handling techniques.

COMPONENTS APPLICATIONS ENGINEERING: Specification and characterization of semiconductor devices for use in advanced computer applications.

SEMICONDUCTOR MATERIALS TECHNOLOGY: Exploration of problems in crystal growth, impurity diffusion, vapor growth processes, crystal processing and photoconductor studies.

TECHNICIANS: Two-year technical school or equivalent experience. Openings in all above areas.

Assignments are in Poughkeepsie, N.Y., a pleasant non-metropolitan environment just 80 miles from New York City. Liberal IBM benefits to include relocation apply. All qualified applicants will be considered for employment without regard to race, creed, color or national origin.

Please call (collect)
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Poughkeepsie, N.Y.
Extension 4823R

Or write, outlining background and interests, to . . .
H. J. Cooke, Dept. 699L
IBM Development Laboratory
Box 390
Poughkeepsie, N.Y.

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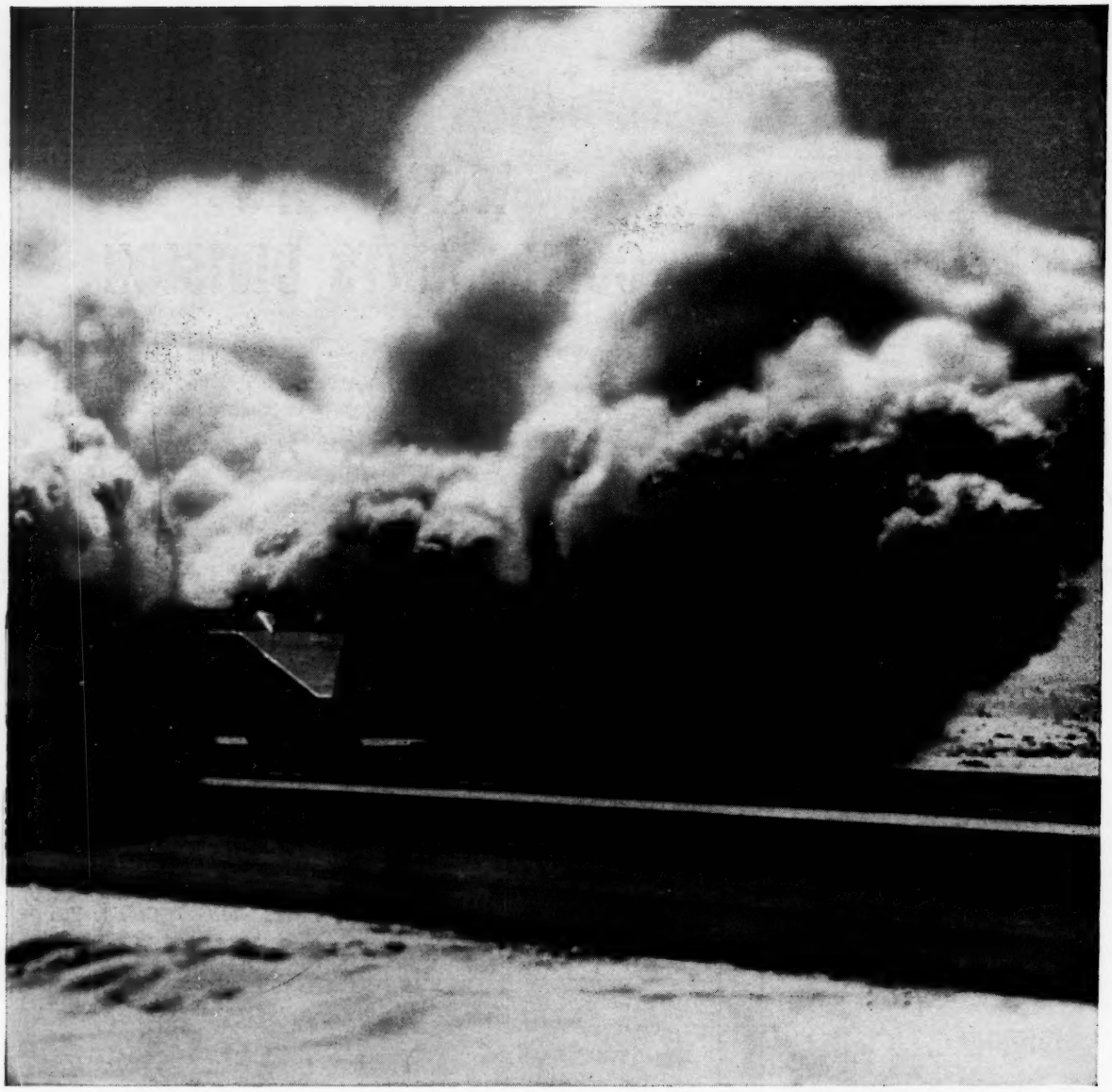

DEPARTMENT OF DEFENSE—AIR FORCE PHOTO

HOW NICKEL TAKES THE MEASURE OF THE WORLD'S FASTEST ROCKET TRACK

This is a 2000-miles-an-hour-plus rocket sled hitting the water brakes ... part of continuing tests by the Air Force Systems Command.

The sled travels on a 35,050-foot track that was built with such precision that even the curvature of the earth was considered in its construction.

Rocket, aircraft, and missile components roaring down this track at Holloman Air Force Base, New Mexico, are timed and photographed right at rail level. How? By blades—set at intervals of exactly 13.00 feet along the track—that interrupt a light beam as the sled rockets by.

To align these vital track blades, a tape made of Invar (36% Nickel) was specified. This nickel-iron alloy has an extremely low coefficient of linear expansion ... virtually eliminates error caused by variations in ambient temperature conditions.

Consequently, there isn't .005-of-an-inch deviation in blade alignment in the *entire* seven miles of track.

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